Standards for KYTC Road Centerlines

Version 1.0

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Kentucky Transportation Cabinet

Office of Technology
Engineering and GIS Branch

Office of Program Planning and
Management, Division of Planning

CONTENTS

Format of document following a modified format of the USGS' Standard for DOQQs < http://giac.state.ky.us/giac_standards_doq.htm>

GENERAL

OBJECTIVES

The Kentucky Transportation Cabinet (KYTC) is recognized as the lead agency for the collection and distribution of statewide road centerline data. The standards specified in this document pertain to the collection, processing, quality control and distribution of road centerline data. KYTC centerline data produced to this standard are shared as one of the Kentucky Statewide Digital Basemap Layers.

A statewide digital road centerline map layer has been in existence since 1991. This has been widely available to external (non-KYTC) users since 1994. The current standard is a set of centerline coverages based from USGS topographic maps (1:24,000) combined into county-based files for maintenance and storage. These are being replaced by Global Positioning System (GPS)-based coverages (< 2-meter accuracy). This document will detail data structure and both old and new collection, processing and distribution methods. The initiative by the Cabinet's Division of Planning to accurately locate (GPS) all public roads is a tremendous boon for the entire state. While this initiative is driven and defined by the Cabinet's internal needs, it is recognized that it will continue to have significant benefits to external agencies and individuals.

This document acts as both a standard and a general metadata document. The standard aspect is critical for building road GIS information that can be incorporated into a statewide dataset. In order to understand some of the idiosyncrasies of the standard it is necessary to incorporate the metadata aspect of the document. This provides users with guidelines for evaluating and using the road centerlines. Current and future centerlines are a conglomeration from many different sources with varying collection methods and accuracies. Users must be aware of the data's strengths and known limitations. It is the user's responsibility to properly employ the data.

This effort to build a statewide road centerline standard, database, and associative metadata supports the Governor's Office of Technology's (GOT) effort to build enterprise based information systems. KYTC's statewide road centerline GPS effort along with this documentation and KYTC information distribution method follows GOT's guiding principles found within the Strategic Information Technology Plan:

1. Support the business objectives of Commonwealth Government;
2. Conduct Commonwealth business electronically;
3. Treat information as a strategic resource;
4. View technology investments from an enterprise perspective; and,
5. Ensure electronic access to information and services while assuring privacy.
   (See http://www.state.ky.us/kirm/edspol.htm)

CONSTRAINTS

Access Constraints
This data set is publicly accessible via the Office of Geographic Information's web site: http://www.state.ky.us/agencies/finance/depts/ogis/gisdept.htm

Use Constraints
This data is intended for general use. No restrictions are set upon it. See disclaimer and accuracy statements below for guidance on use.

DISCLAIMER

While all attempts are made to insure the correctness and suitability of information under our control and to correct any errors brought to our attention, no representation or guarantee can be made as to the correctness or suitability of that information or any linked information presented, referenced, or implied. All critical information should be independently verified. Any questions should be directed to the administrator/s of this or any other specific datasets.

DEFINITIONS

Accuracy - This is an indication of how close a measurement is to the true value. The best accuracy any GPS receiver can expect to attain depends on the quality of the receiver, position of the satellites, environmental variables (weather, sunspots, terrain, etc.) and Selective Availability (SA). Greater accuracy is obtained when the occupation time is increased and differential correction techniques are applied. (See KYTC, Planning 2002).

ADD - Area Development District

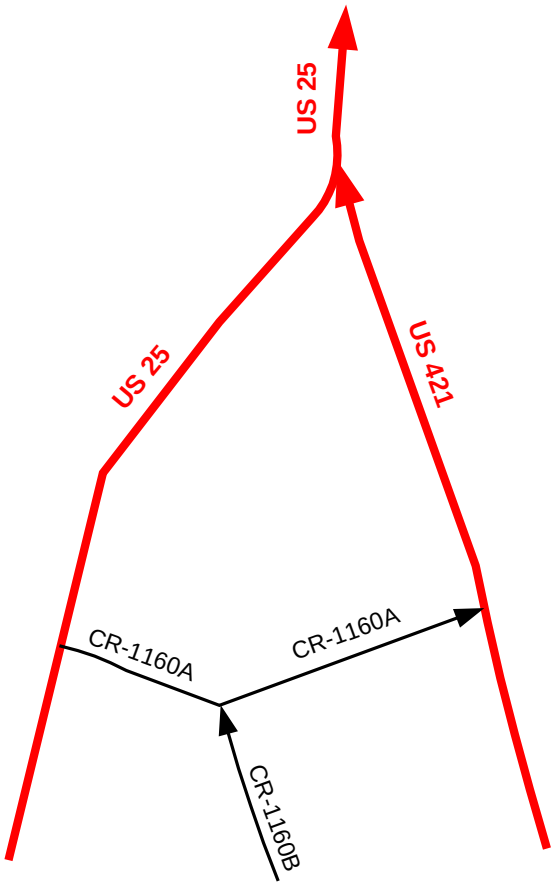
ASPEN® - Software is Trimble's GIS data collection and data maintenance tool that runs on pen or notebook computers. It is used in the field while collecting GPS data. (See http://www.trimble.com/aspen.html)

Attribute - These are characteristics of features in a Geographic Information System (GIS). Every identifiable feature has attributes. One common attribute of all survey features is geographic position. Other attributes depend on the type of feature. For example, a road has a name or designation number, surface type, etc. Each attribute has a range of possible values, called a domain. (See KYTC, Planning 2002).

Cardinal Direction - The direction a road is mile pointed. On state maintained roads, the origin is from the county line or beginning point to an ending mile point at another location, as described in the Official Orders for the county. This, generally, is north or eastbound. On city streets or county roads the cardinal direction is the direction of traffic flow away from a US, state or more highly traveled county road toward a lesser traveled street, county road or dead end. If you have a local road traveling

between two road of equal system level (i.e. US Highway to US Highway), then the origin point would be from the lower numbered road (Figure 1). When referring to one way streets, it is the direction of traffic flow.

Figure 1 Cardinality Rules Example



Control Point (NGS Control Point) - An accurately known reference point used for comparing to field data. Control points must achieve an accuracy level of Horizontal B-order stations (a relative accuracy of 8 mm +/- 1:1,000,000 relative to other A-order and B-order stations). (See KYTC, Planning 2002 AND http://ngs.state.ky.us/).

County Number - is a three digit number (001 – 120) assigned to each county in Kentucky based on its position in alphabetical order (See County Prefix Section below, Appendix I & GOT 1999:32).

County Quadrant (Quad or County Quad) - This is an arbitrary splitting of a county into four quadrants for road name indexing purposes for the KYTC Division of Rural and Municipal Aid. The

numbering starts in the Northeast quadrant and progresses clockwise. *There is no intended correlation with USGS 7.5' topographic quad boundaries, if any occurs it is purely coincidental.*

Couplet-ID - is the traditional name for a marker in the road identification field (LRS_ID) that indicates a non-standard configuration of the roadway. For example non-cardinal divided highways, cross-overs, connectors, rest areas, weigh stations, etc.. Its position in the LRS_ID is after the suffix. The "Couplet-id" is being replaced by the Section-ID (see below).

Coverage – A digital version of a map layer forming the basic unit of vector data storage for ARC/INFO. A set of thematically associated data considered as a unit. A coverage usually represents a single theme such as soils, streams, roads, or land use. (*(See Reference 1:Glossary –14*)

Data Dictionary - Information that describes features located in the field is the data dictionary. This description includes data type classification (point, line, or area), attribute names, attribute types, and a list of valid attribute values. After being created, a data dictionary is downloaded to a data logger and used when collecting data in the field. *(See KYTC, Planning 2002).*

DD - Abbreviation for Geographic Coordinates stored in Decimal-Degrees.

Differential GPS (DGPS) - The term "differential" is generally used with pseudorange methods, which resolve the errors in a single position. One of these methods is real-time DGPS, which resolve the errors in real time, in contrast to the approach of relative GPS. This is achieved by clear acquisition (C/A) code-phase (pseudo-range) error measurements at one or more stations and transmitting the data to the remote station(s). *(See KYTC, Planning 2002).*

DMS - Abbreviation for Geographic Coordinates stored in Degrees-Minutes-Seconds.

Domain - The range of possible values for an attribute.

Epoch - This is the measurement interval of a GPS receiver. *(See KYTC, Planning 2002).*

ESRI - Environmental Systems Research Institute. Their software suite is defined as the standard for GIS in Kentucky State Government. (See www.ESRI.com).

GIS - A Geographic Information System is an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.

GPS - Global Positioning System is a tool for determining your location on the earth. It is based on a constellation of 24 satellites sending very precise time signals. Differences between these signals allow the GPS unit to triangulate its location.

GPS Pathfinder Office - Software used in the office for preparation for and post-GPS-fieldwork data manipulation in preparation of importing into a GIS.
(See http://www.trimble.com/pathfinderoffice.html)

GRS(80) - The spheroid used in the Kentucky State Plane Coordinate System Projection.

HIS - Kentucky Transportation Cabinet's Highway Information System. It is the Cabinet's main repository for highway attribute information.

Local Road - Non-state maintained road. *(See KYTC, Planning 2002).*

National Standard For Spatial Data Accuracy (NSSDA) - implements a well-defined statistic and testing methodology for positional accuracy of maps and geospatial data derived from sources such as aerial photographs, satellite imagery, or maps. Accuracy is reported in ground units. The testing methodology is a comparison of a dataset's coordinate values with coordinate values from a higher accuracy source for points that represent features readily visible or recoverable from the ground. *(See http://www.fgdc.gov/standards/status/sub1_3.html)*

Non-cardinal Direction - The direction that is opposite to the cardinal direction. This term is primarily used to refer to the traffic flow lanes of a divided road that are not in the cardinal direction.

Official Order – in this context, it is a legal document prepared by the Division of Planning (approved by the Commissioner of Highways or an authorized representative), that officially modifies the State Primary Road System, the National Truck Network, or the Scenic Highways and Byways Program. Possible modifications may include to accept, transfer, reclassify, close, redefine and/or re-describe various routes. *NOTE: there are many other sources of Official Orders within the Cabinet that do not impact the GIS/GPS effort. These others are not intended to be referenced here and would not meet the above definition.*

Private Road - A road is considered a private road if it; (1) serves only one home, business, or other facility, (2) Is signed as private, (3) is closed to the public by a gate or chain, *unless* it is maintained by a public authority (i.e. cemetery road owned by a local government or a county park) or (4) is impassable to a standard highway vehicle. All private roads within the KYTC coverages/shapefiles are accessible to the public. *(See KYTC, Planning 2002).*

Public Road - A "Public Road" is any road that is open to public travel. Examples include: state maintained roads, county maintained roads, state park roads, city streets, federally owned roads (forest service, national park, etc.), private roads, private subdivision roads, coal mine owned roads (open to public travel). *(See KYTC, Planning 2002).*

Road Centerline - This is a representation of a road with the spatial position following the approximate center of the road. It is commonly used on small-scale maps to represent roads.

Section-ID - is the name for a marker in the road identification field (LRS_ID) that indicates a non-standard configuration of the roadway. For example non-cardinal divided highways, cross-overs,

connectors, rest areas, weigh stations, etc.. Its position in the LRS_ID is after the suffix. The "Section-ID replaces the Couplet-id" (see discussion in the "Valid Section-ID Values" below).

Selective Availability (SA) - Artificial degradation of the satellite signal by the United States of America Department of Defense. It has been turned off and so is not currently an issue on GPS accuracy. It could be turned back on with an executive order by the President.

Shapefile - An ESRI-based file format for storing spatially enabled data. See the "ESRI Shapefile Technical Description." It can be found on the ESRI web site (*See http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf)*

State Road - A road that is under jurisdictional and operational control of the Commonwealth of Kentucky.

WGS-84 - The World Geodetic System (1984) is the mathematical ellipsoid used by GPS since 1984. Data captured by WGS(84) varies positionally from GRS(80) referenced data by approximately 1 meter.

SPECIFICATIONS

PRODUCT DESCRIPTION

Current Products

KYTC has developed road centerline GIS files for all publicly accessible roads in Kentucky. KYTC shares the road data via OGI using two statewide map layers: state-maintained roads (staterds) and local roads (localrds). These are also broken down and shared by county (naming conventions are described in the Delivered File Formats Section).

Future Products

In the near future KYTC will be delivering a single statewide map layer that combines both local and state-maintained roads into one map layer. County-level breakdowns of this will still be provided as well.

GEOGRAPHIC EXTENT

The Statewide road centerline map layers have a geographic extent that spans the entire state. The state's bounding coordinates in decimal degrees are:

North: 39.147732

West: -89.571205 East: -81.964790

South: 36.497059

All Kentucky roads will fall within this box. It should be noted that adjoining states will share some of this same coordinate space within these parameters as well.

COORDINATES & DATUM

The data provided to the OGI web server uses the standard DD projection.

Map Projection:	Geographic (Latitude/Longitude)
Map Units:	Degrees Decimal (DD)
Z-units:	NO
Datum:	NAD83
Spheroid:	GRS1980
X-shift:	0.0000000000
Y-shift:	0.0000000000

In the near future the data will be shared in the Kentucky Single Zone (KYSZ) Projection.

Map Projection:	LAMBERT
Map Units:	FEET
Z-units:	NO
Datum:	NAD83
Spheroid:	GRS1980
X-shift:	0.0000000000
Y-shift:	0.0000000000
Parameters:	
37 5 0.000 /* 1st standard parallel	
38 40 0.000 /* 2nd standard parallel	
-85 45 0.000 /* central meridian	
36 20 0.000 /* latitude of projection's origin	
1500000.00000 /* false easting (meters)	
1000000.00000 /* false northing (meters)	

NOTE: Due to a software limitation in ArcView 3.2 and ArcMap 8.1.2 one must tweak the view frame projection definition in order to overlay DD vector data onto KY1Z raster data. Convert the False Northings and Eastings to US Survey feet to match the map units:

False Northing = 3280833.33333 (USFt)
False Easting = 4921250.00000 (USFt)

The base data is stored and edited in the standard State Plane projections:

State Plane - NORTH

Map Projection:	STATEPLANE
Zone:	3976
Datum:	NAD83 (NADCON)
Z-units:	NO
Units:	FEET (US Survey)
Spheroid:	GRS1980
X-shift:	0.0000000000
Y-shift:	0.0000000000

State Plane - SOUTH

Map Projection:	STATEPLANE
Zone:	4001
Datum:	NAD83 (NADCON)
Z-units:	NO
Units:	FEET (US Survey)
Spheroid:	GRS1980
X-shift:	0.0000000000
Y-shift:	0.0000000000

The GPS-ed data is originally collected in Latitude/Longitude (DMS).

Map Projection:	Geographic (Latitude/Longitude)
Map Units:	Degrees (DMS)
Z-units:	METERS
Datum:	WGS(84)
Spheroid:	WGS(84)
X-shift:	0.0000000000
Y-shift:	0.0000000000

METHODOLOGY

The centerline data goes through the following processes: data collection, data clean up, verification of accuracy, formatting into distributable GIS files, and publication/sharing. The following sections describe these processes. Due to the complexity of building the LRS_ID field, two independent sections (Coding Conventions for LRS_ID & Road Numbering) are devoted to this. The following sections describe these individual processes.

COLLECTION METHODS

Both the previous (USGS Topographic Map-based) and current (GPS-based) collections methods are described below. The new methods include the KYTC example for centerline collection that meets the defined accuracy level.

Previous Collection Methods

In the early 1990s, KYTC's Division of Planning used the USGS 7.5' Topographic Quadrangle (quads) maps as the foundation for digitizing all public roads within the state. The paper quads were scanned in and registered. Heads-up digitizing captured the roads from the quads into two coverages (state-maintained & local roads). The individual quads for each layer (state-maintained/local) were knitted together to form county-level coverages for maintenance and distribution. New roads and alignment changes to the existing road layers were added using As-Builts, field maps, and a variety of external agencies' documents. A formal accuracy assessment methodology and statement were not developed during this time period. See the Accuracy Section below for a general accuracy statement for data collected using this methodology.

New Data Collection Methods

KYTC's Division of Planning has defined the current accuracy criteria and methodology for road centerline data collection. While the majority of the fieldwork is being performed by external entities (commonly ADDs), each county's centerline collection must conform to these criteria. While alternative methods for data collection can be used (photogrammetry, etc.), *all data to be incorporated into KYTC coverages must meet or exceed the accuracy level defined in this document and are subject to independent accuracy validation.* The methods described below are provided as a successful blueprint for collecting centerline data at the KYTC defined accuracy level.

KYTC Data Collection Method

All public roads (defined above) are to be collected. The primary technology designated for use in road centerline collection is GPS. A GPS unit is mounted on vehicles (with the antenna on the driver's side) and roads are driven at normal traffic speeds. Antenna location on the vehicle & height (in feet & meters) is recorded in order to offset properly the centerline from the collection point. At least 95% of the mileage of all state maintained roads is located with differential GPS. At least 95% of the total mileage should be collected with DGPS. KYTC and its current contractors are using ASPEN software for the collection of road centerline GPS data. Epoch recording rate is to be 1 second for all roads except for Interstates. The epoch rate for Interstate should be 5 seconds. This provides efficient data capture while meeting the accuracy requirements.

Alternative less accurate methods for collecting road position can be employed, such as DOQQs, but must be identified in the "Mapsource" field of the raw GPS data and cannot exceed 5% of the total mileage or 5% of the state maintained road mileage.

Two important data attributes that should be addressed in field data collection are directionality and arc breaks. KYTC's experience has found that more errors occur if these are left to the office cleanup phase.

Directionality: All non-divided state roads were driven in two directions and then collapsed to generate a centerline. Divided Highways (where medians exist) were driven in both directions and then retained separately in the coverage. All local and one-way roads were driven in one direction and the appropriate offset applied.

Arc Breaks: Arcs must break at pavement changes and the beginning and ending points of all ramps, Y-intersections, crossovers, and connectors. (Post-fieldwork processing will add breaks at city and county boundaries).

DATA CLEAN-UP

After field collection of GPS centerline data, it should be brought into a GIS and processed to remove obvious errors (both spatial and attribute). This involves cleaning up a variety of errors including spatial (multipath, over and undershoots, arc directionality reversals, etc.) and attribute errors (data-entry miscoding, omission, transposition and "fat-finger"). The data is also compared to known control points and lines for spatial verification of accuracy (see accuracy section below).

ACCURACY VERIFICATION

Horizontal Accuracy Verification Methods

KYTC's spatial accuracy verification methodology is an adoption of the National Standard For Spatial Data Accuracy (NSSDA) testing methodology (FGDC-SBCD 1998:3-4). A **minimum** of 20 road intersection control points is taken within each county using DGPS. These locations are distributed proportionately throughout each county to reflect the geographic area of interest and distribute any error. Each control point is monumented with a P-K (a hardened masonry nail with a central dimple) or MAG nail (magnetized nail that is detectable even if buried). A DGPS unit is mounted onto a tripod over the point and a minimum of 180 positions is taken using a 1-second point-logging interval. KYTC then randomly tests a subset of these control points for each county to corroborate accuracy of the centerlines. *Please note that these control points are for GPS centerline accuracy testing purposes only. They should not be used for land surveying purposes.*

Accuracy Statement

Previous Collection Accuracy
For the pre-GPS-ed road centerline data, the target horizontal accuracy for the road layers was 1:24,000 (+/- 40 feet). Given the variety of sources for the data, it is recognized that the older centerlines do not always meet published national map accuracy standards.

Current Collection Accuracy
For data currently being collected and all GPS-based road centerline data, the KYTC Division of Planning uses the geospatial positional accuracy standards proposed by the Federal Geodetic Control Subcommittee (FGCS 1994). Road centerline collection methods are based on pseudorange measurements (FGCS Classification Band IX). These differential GPS (DGPS) methods, either in post processed or real-time modes, provide a resulting horizontal accuracy of 0.500 – 2.000 meter radius of the relative positional error circle with a 95% confidence.

The target accuracy for new collection is sub-meter (< 1.0 meter), but it is recognized that some field conditions prevent attaining this. All coverages will have a published accuracy statement containing a relative positional error radius and a confidence level.

KYTC ROAD CENTERLINE FILE FORMATTING

The KYTC road centerline structure has traditionally been based on an ArcInfo coverage model. A road centerline coverage must be structured to allow for use with the existing HIS database. The road centerlines maintain direction flows following the cardinality and arc break rules described above.

The table below describes the tabular data structure maintained in the state-maintained and local road coverages and corresponding shapefiles. *Any data to be incorporated into the KYTC road centerline dataset must have this structure.*

File Structure Description and Field Definitions

TABLE 1

COLUMN POSITION	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC
1	FNODE#	4	5	B	-
5	TNODE#	4	5	B	-
9	LPOLY#	4	5	B	-
13	RPOLY#	4	5	B	-
17	LENGTH	8	18	F	5
25	cover#	4	5	B	-
29	cover-ID	4	5	B	-
-------Default ArcInfo items above this line ----------					
33	LRS_ID	17	17	C	-
50	BEGIN_MP	7	7	N	3
57	END_MP	7	7	N	3
64	ORDERDATE	8	8	D	-
72	LINKDATE	8	8	D	-
80	DRAWCODE	4	4	I	-
84	RD_NAME	40	40	C	-
124	SURFTYPE	2	2	I	-
126	ROUTE	13	13	C	-
139	ROUTE_NBR	10	10	C	-
149	GRAPHIC_LEN_MI	7		N	3
156	DMI_LEN_MI	7	7	N	3
163	MAP_SOURCE	1	1	I	
164	GOV_LEVEL	2	2	I	
166	RSE_UNIQUE	17	17	C	0
183	LOCAL_KEY	50	50	C	-

Below is a data dictionary describing the fields in Table 1 (excluding the default ArcInfo Fields).

LRS_ID - Linear Referencing System (LRS) Identifier corresponds to the HIS field RSE_UNIQUE. The LRS_ID is recorded as follows <CCC XX-YYYYZZ-NNN>. Its structure is a three-digit county number (CCC), white space, route prefix (XX), dash, route number (YYYY), route suffix (ZZ), dash, Section-ID (NNN). A "Section-ID" (sometimes called a Couplet-ID) designates highway network anomalies such as one-way streets, Y-intersections, etc.. An example of an LRS_ID for a segment of US Highway 127 in Franklin County is *"037 US-127X-002"*. *NOTE: the LRS_ID field is a replacement to the RSE_UNIQUE. All future project development should reference LRS_ID rather than the RSE_UNIQUE field.*

BEGIN_MP - This data represents the official state beginning milepost value of a route. Example: 111.327

END_MP - This data represents the official state ending milepost value of a route. Example: 125.435

ORDERDATE - The date appearing on the 'Official Order' document used to update the map.

LINKDATE - The date that the map graphic was last updated.

DRAWCODE - Drawing code represents highway system or pavement types. These values are used to produce colored lines during editing sessions and do not contain official highway characteristic information. See http://www.kytc.state.ky.us/planning/gisourky/Documents/RtPrefix.doc for a list of valid code values.

RD_NAME - Road Name Full city street or county road name defined by the local authorities. There are two sources for road names. The County Physical Court and the MSAG emergency database. These should be in agreement, but if the local authorities cannot reach agreement the physical court name will be recorded.

SURFTYPE - Roadway surfacing type. Its corresponding HIS field is (SURFTYPE in Pavement View). An additional KYTC reference document is the *HIS- Inventory Types/Attributes/Values Report*.

Values:
20 Unimproved
40 Soil, Gravel, or Stone
52 Bituminous
70 Concrete

ROUTE - This field is a textual highway route description without the county number. It is used to label roadway graphics. *NOTE: An item with the same name is found in the Route Attribute Table (RAT) and does not contain the same information. The RAT file represents unique state road designations.*

ROUTE_NBR - This field is another text field containing the highway route number that is used to insert route labels into route shields for map labeling.

GRAPHIC_LEN_MI - is the computed length of each arc (in miles). This is computed from the arc length in map units (feet) divided by 5280.

DMI_LEN_MI - This is the official length of the road based on an official order measured with a Distance Measuring Instrument (DMI). This data is computed by subtracting the 'begin_mp' column from the 'end_mp'.

GOV_LEVEL - is the ownership or government level of control for the roadway.

Values:
01 - State
02 - County
04 - City
11 - State Park or State Forest
12 - Local Park or Forest
21 - Other State Agency Roads
25 - Other Local Agency Roads
26 - Private Roads
60 - Other Federal Agency Roads
64 - U S Forest Service Roads
66 - National Park Service Roads
70 - Military & Corps of Engineers Roads
89 - New Location: Open to traffic, but not yet accepted
98 - Route belongs to adjacent state (e.g. US-52, Grant Bridge, etc.)
99 - New Location: Proposed or Under Construction

MAPSOURCE - is the road centerline source used to produce the roadway graphic. The corresponding HIS field is MAP_SOURCE.

Values:
1. GPS
2. DOQQ - Heads-up digitized from Digital Orthophoto
3. DRG - Heads-up digitized from Digital Raster Graphic
9. OTHER SOURCE

RSE_UNIQUE - this is the original linear referencing system identifier. It has been replaced on the GIS side by the LRS_ID field. All future project development should reference LRS_ID rather than the RSE_UNIQUE field. See the LRS_ID description above.

LOCAL_KEY - this is a new field added (12/2001) in order to accommodate the incorporation of locally collected data and to allow for external databases (like local address ranges) to be tied to KYTC spatial data. The field is intentionally large in order to accommodate a variety of possible structures for a unique ID.

If a local entity is in the process of developing a GIS, we recommend using the FIPS County Code (See Appendix I) plus a "-" plus a five digit arbitrary number for each unique arc. The Structure would look like " These unique IDs should not be repeated and if an arc is split or combined with another arc the unique ID should be retired and a new ID assigned.

CODING CONVENTIONS FOR LRS_ID

The LRS_ID is part of the primary key for KYTC road information. The complete primary key is LRS_ID plus Begin_MP plus End_MP. This uniquely identifies *exactly* where information occurs

along the roadways of Kentucky. Due to the importance and the complexity of the information within the LRS_ID, this section details the different pieces and their respective coding. Below are the valid codes for route prefixes, parkways, and suffixes. See http://www.kytc.state.ky.us/planning/gisourky/Documents/RtPrefix.doc for additional reference.

Valid COUNTY Numbers
See GOT's (1999:32) definition of valid county numbers and Appendix I below.

Valid Route PREFIX Abbreviation Values:

Federal Routes
- I = Interstate
- US = Federal Route
- FD = Forest Service or Federal Agency

State Routes
- KY = State Route
- ST = Other State Agency
- IC = State Park Road
- NL = New Location of State Highway not Officially Open

Local Routes
- CR = County Road
- CS = City Street

Private Roads
- PR = Private Road
- PV = Private Driveway
- PS = Private Subdivision

Valid PARKWAY Route Designations*:*
Parkways are special state routes designated by unique Route prefix (except for the Mountain Parkway and its extension) and a 9000 series route number. See the list below.

KY-9000	Bert T. Combs Mountain Parkway
WK-9001	Wendell H. Ford Western Kentucky Parkway
BG-9002	Bluegrass Parkway
JC-9003	Julian M. Carroll Parkway
EB-9004	Edward T. Breathitt Parkway
AU-9005	Audubon Parkway
DB-9006	Daniel Boone Parkway
WN-9007	William H. Natcher Parkway
LN-9008	Louie B. Nunn Parkway
KY-9009	Mountain Parkway Extension

Valid Route NUMBER

The number must be between 1 and 9,999. The leading zeros are dropped.

Valid SUFFIX Abbreviations Values:

(for State Maintained roads (Gov_Level = 01):

A - Alternate
B - Bypass
C - Connector
E - East
EX - East Business
NL – New Location
S - Spur
T – Truck
W – West
WB - West Bypass
WX – West Business
X – Business

Valid Section (Couplet) -ID Values

1 – 9 Non-Cardinal Sections

NOTE: In the example 003 US-127-1, the"-1" indicates a Section-ID that marks the non-cardinal side of a state maintained route.

10 Non-Cardinal side of Divided Highway

11-19 Rest Areas, Weigh Stations, Scenic Views in conjunction with Interstates and Parkways

20 - 29 Y's

30 - 69 Crossovers

70 - 79 Connectors

80 - 99 Other: bays, cul-de-sacs, spurs, frontage roads, etc. plus any overflow from the above

111 - 999 Interchange ramp

The consistent coding of interchanges is quite complex. Figure 2 (below) is an example of the challenges of developing a method to consistently identify and record information on or within interchanges.

Figure 2 Example of the Challenges of Coding Ramp Information

Below is the system KYTC has developed to uniquely code each road segment within an interchange. (See http://www.kytc.state.ky.us/planning/gisourky/images/pdf/gps/ramps.pdf for a visual example)

The FIRST DIGIT is the *Interchange Number* - a sequential number increasing in the cardinal direction from the county line.

***NOTE**: for routes with more than 9 interchanges in a county the SECOND Digit (coded with a number between 5 and 8) in combination with the FIRST Digit is used to designate the Interchange Number AND its Quadrant Number.*

The SECOND DIGIT is the *Quadrant Number* - a sequential number starting to the right of the cardinal side of the primary route as it approaches and increasing counterclockwise from 1 to 4 and 5 to 8 (for interchanges numbered above 9).

NOTES

- *If it is coded from 5 to 8 (to designate an interchange number greater than 9), subtract 4 from the coded number to get the true quadrant. Example: Coded = 7; True Quadrant is 3 (7-4 = 3).*
- *The numbers 0 and 9 are not allowed.*

The THIRD DIGIT is the *Ramp Location* - a sequential number marking the ramp position. The outermost lane is assigned the number 1 with subsequent lanes assigned sequential numbers to the inside lane.

See Table 2 Below.

Table 2 Examples of Couplets and What Their Coding Represents

Couplet	**True** Interchange Number	**Assigned** Interchange Number (First Digit)	**True** Quadrant Number	**Assigned** Quadrant Number (Second Digit)	Ramp Location (Third Digit)	Comment
111	1	1	1	1	1	
112	1	1	1	1	2	Second ramp from outside lane
121	1	1	2	2	1	
131	1	1	3	3	1	
141	1	1	4	4	1	
151	10	1	1	5	1	
162	10	1	2	6	2	Second ramp from outside lane
171	10	1	3	7	1	
183	10	1	4	8	3	Third ramp from outside lane
211	2	2	1	1	1	
221	2	2	2	2	1	
231	2	2	3	3	1	
241	2	2	4	4	1	
251	11	2	1	5	1	
261	11	2	2	6	1	
274	11	2	3	7	4	Fourth ramp from outside lane
281	11	2	4	8	1	
…	…	…	…	…	…	
361	12	3	2	6	1	
471	13	4	3	7	1	
581	14	5	4	8	1	
665	15	6	2	6	5	Fifth ramp from outside lane
771	16	7	3	7	1	
812	8	8	1	1	2	Second ramp from outside lane
863	17	8	2	6	3	Third ramp from outside lane
911	9	9	1	1	1	
921	9	9	2	2	1	
951	18	9	1	5	1	
971	18	9	3	7	1	

ROAD AND STREET NUMBERING CONVENTIONS

Numbering City Streets

All roads owned by an incorporated area use the prefix “CS.” The preference is for all street numbers within a city to be clustered. Therefore cities will be assigned blocks of numbers to allow for future moderate growth. The County seat receives the first assignment starting at CS-1000. Then as a general rule all other cities are assigned moving from the largest population center to the smallest based on the current census figures when street numbers are first assigned. There may be exceptions to this. Within each county, city streets will be numbered from 1000 to 9999. Counties with more than 8,999 distinct

city streets will use a suffix to uniquely identify streets that may share the same four-digit street number.

Federal Agency Roads
All roads owned by Federal Agencies that have had a number previously assigned by that agency should retain the number with an "FD" added in the prefix position. They have a valid range from 1 to 9999 within each county.

Private Roads

Private Abbreviation Conventions

PR – A privately owned and maintained road that is public in use
PS – A privately owned and maintained development (e.g. trailer park, recreational development, or private subdivision) that is public in use.
PV – A privately owned and maintained route that is **not** public in use (factory entrance, driveway)

Private Numbering Scheme

The numbering convention for "PR" (Private Road), "PS" (Private Subdivision), and "PV" (Private Driveway) should follow the same format as County Road Series maps' numbering of county roads (see below). For example, the first private road in county quad #1 should begin with the number of "PR-1001", with following roads numbered consecutively (e.g., the second private road "PR-1002, and so on). The sequence of numbering the roads should be as follows:

Quad 1 PR-1001 – PR-1099
Quad 2 PR-1101 – PR-1199
Quad 3 PR-1201 – PR-1299
Quad 4 PR-1301 – PR-1399

Since the prefix field (PR, PS, or PV) allows the number to be unique the same rules will also apply to the "PS" and "PV" roads:

County Roads
County roads are uniquely identified by the LRS_ID. This numbering system is a perpetuation of a long-standing paper-map based method that ties into a variety of accounting systems within the Cabinet. Therefore "adjustments" have been required over time to keep the current system functional.

All county-owned roads must have a route number between 1000 and 1999. For counties that have more than 1000 roads, a suffix of the "County Quad" (Q1…Q4) can be assigned to allow for more routes. Example: 003 CR-1201 would be a distinct route from 003CR-1201Q1.

Additionally, in cases where too many county roads lie too close together to adequately label the County Road Aid Series Maps' defined scale (1:125,000), inset suffixes have been applied. The target roads will be assigned a single unique number with the individual roads receiving an alphabetic suffix of up to two characters (a … zz). A road number example in Scott County in Inset 2 is "105 CR-1123A to 105 CR-1123G"

However the suffixes used by county roads do not carry meaning beyond uniquely identifying a road. In some instances, the suffix will indicate what county quadrant the road falls within, but this cannot always be assumed.

Road Numbering Shortage Procedures
In counties where roads outnumber the currently used numbering scheme, and all original 1000 numbers have been assigned, the suffix "Q1, Q2, Q3, or Q4" for the corresponding quad, shall be assigned and the original numbering scheme of that county repeated. **All original 1000 numbers must be used first.** For instance, if the county numbering scheme has a pattern of:

Quad 1 1000-1099 & 1500-1599
Quad 2 1100-1199 & 1600-1699
Quad 3 1200-1299 & 1700-1799
Quad 4 1300-1399 & 1400-1499

Then 1800-1899 would be assigned to first quad that needed more than 200 numbers and 1900-1999 would be assigned to second quad that needed more than 200 numbers.

Once the numbers for the individual quads have been exhausted, then the numbers already assigned to each quad shall be repeated and a "Q" with the corresponding county quad number added as a suffix.

One example, assuming quad 3 had used all 200 numbers, originally assigned, plus the additional numbers (1800 and/or 1900 series) and it is then found that quad 3 needs still more numbers. The next step would be to use the numbers that have already been assigned to quad 3 with "Q3" added as a suffix (CR-1200Q3, CR-1201Q3, CR-1202Q3, and so on).

It is important that the original numbering scheme of the individual counties stay intact and then repeated once all other options have been exhausted. This would preclude using the same route number with different suffixes for different streets in an inset since the "Q1" would already occupy the suffix position. Therefore, neither the number "CR-1001Q1A" nor "CR-1001AQ1" are valid for use in an inset since the "Q1" is already in the suffix position. In this case, "CR-1001Q1" would be used and then the next sequential number "CR-1002Q1" should be used. See KYTC Planning 2002 document.

DELIVERED FILE FORMATS

Data delivered to the OGI server for public distribution are in ESRI E00 and shapefile formats. See the "Coordinates and Datum" section above for projection information. The data may be downloaded by statewide or county formats.

The statewide naming conventions for E00 and shapefiles are as follows:
State Roads
Staterds.e00
Staterds.shp, .shx, .dbf
Local Roads
Localrds.e00
Localrds.shp, .shx, .dbf
NOTE: For shapefiles, all three file types must be present for a shapefile to work properly. Other indexing files may also be included.

The county level files are named with a county abbreviation followed by a suffix to mark the level of road ownership (State vs. Local). The files are assigned by the first 4 letters of each county name with the following exceptions: Lee (LEE), Greenup (GRNP), McCracken (MCRA), and McCreary (MCRE). The suffix "strd" marks state road files and "loca" designates local road files. Examples are "adailoca" for Adair County local roads and "fultstrd" for Fulton County state roads.

CONTACT INFORMATION

For questions regarding this standard please contact:

Greg Witt
Division of Planning
Kentucky Transportation Cabinet
Phone #: (502) 564-7183
E-mail: greg.witt@mail.state.ky.us

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APPENDIX I: Table of County Numbers and FIPS Codes

County Name	County Prefix	FIPS Code	County Number
Adair	Adai	001	1
Allen	Alle	003	2
Anderson	Ande	005	3
Ballard	Ball	007	4
Barren	Barr	009	5
Bath	bath	011	6
Bell	bell	013	7
Boone	boon	015	8
Bourbon	bour	017	9
Boyd	boyd	019	10
Boyle	boyl	021	11
Bracken	brac	023	12
Breathitt	brea	025	13
Breckinridge	brec	027	14
Bullitt	bull	029	15
Butler	butl	031	16
Caldwell	cald	033	17
Calloway	call	035	18
Campbell	camp	037	19
Carlisle	carl	039	20
Carroll	carr	041	21
Carter	cart	043	22
Casey	case	045	23
Christian	chri	047	24
Clark	clar	049	25
Clay	clay	051	26
Clinton	clin	053	27
Crittenden	crit	055	28
Cumberland	cumb	057	29
Daviess	davi	059	30
Edmonson	edmo	061	31
Elliott	elli	063	32
Estill	esti	065	33
Fayette	faye	067	34
Fleming	flem	069	35
Floyd	floy	071	36
Franklin	fran	073	37
Fulton	fult	075	38
Gallatin	gall	077	39
Garrard	garr	079	40
Grant	gran	081	41
Graves	grav	083	42

County Name	County Prefix	FIPS Code	County Number
Grayson	gray	085	43
Green	gree	087	44
Greenup	grnp	089	45
Hancock	hanc	091	46
Hardin	hard	093	47
Harlan	harl	095	48
Harrison	harr	097	49
Hart	hart	099	50
Henderson	hend	101	51
Henry	henr	103	52
Hickman	hick	105	53
Hopkins	hopk	107	54
Jackson	jack	109	55
Jefferson	jeff	111	56
Jessamine	jess	113	57
Johnson	john	115	58
Kenton	kent	117	59
Knott	knot	119	60
Knox	knox	121	61
Larue	laru	123	62
Laurel	laur	125	63
Lawrence	lawr	127	64
Lee	lee	129	65
Leslie	lesl	131	66
Letcher	letc	133	67
Lewis	lewi	135	68
Lincoln	linc	137	69
Livingston	livi	139	70
Logan	loga	141	71
Lyon	lyon	143	72
McCracken	mcra	145	73
McCreary	mcre	147	74
McLean	mcle	149	75
Madison	madi	151	76
Magoffin	mago	153	77
Marion	mari	155	78
Marshall	mars	157	79
Martin	mart	159	80
Mason	maso	161	81
Meade	mead	163	82
Menifee	meni	165	83
Mercer	merc	167	84

County Name	County Prefix	FIPS Code	County Number
Metcalfe	metc	169	85
Monroe	monr	171	86
Montgomery	mont	173	87
Morgan	morg	175	88
Muhlenberg	muhl	177	89
Nelson	nels	179	90
Nicholas	nich	181	91
Ohio	ohio	183	92
Oldham	oldh	185	93
Owen	owen	187	94
Owsley	owsl	189	95
Pendleton	pend	191	96
Perry	perr	193	97
Pike	pike	195	98
Powell	powe	197	99
Pulaski	pula	199	100
Robertson	robe	201	101
Rockcastle	rock	203	102
Rowan	rowa	205	103
Russell	russ	207	104
Scott	scot	209	105
Shelby	shel	211	106
Simpson	simp	213	107
Spencer	spen	215	108
Taylor	tayl	217	109
Todd	todd	219	110
Trigg	trig	221	111
Trimble	trim	223	112
Union	unio	225	113
Warren	warr	227	114
Washington	wash	229	115
Wayne	wayn	231	116
Webster	webs	233	117
Whitley	whit	235	118
Wolfe	wolf	237	119
Woodford	wood	239	120